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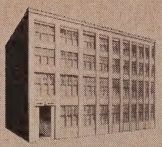

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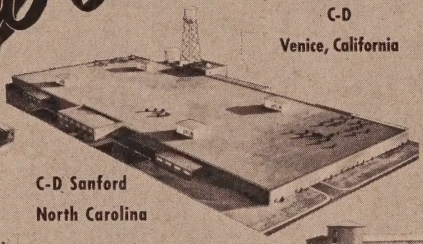

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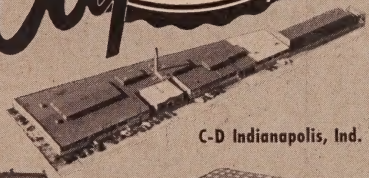

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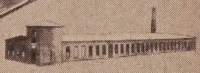

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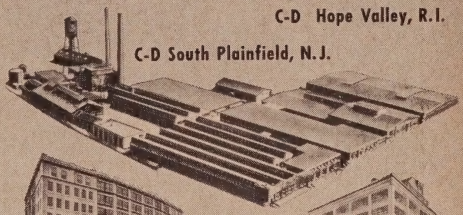

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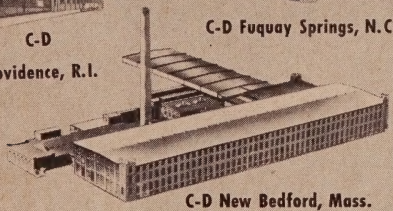

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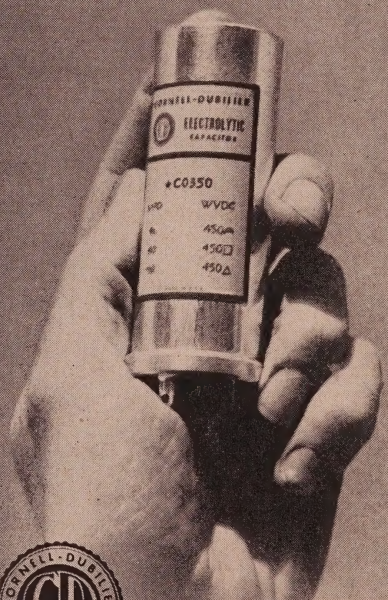

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TESTING POWER TRANSISTORS

The basic electrical difference between a power transistor and the conventional junction transistor is the higher current-handling capacity of the power unit. In most instances, the d-c operating voltages are the same for both types. It follows that the power dissipation and heating are higher in the power type. Because the junctions in the power transistor are larger, internal capacitances are higher, maximum operating frequency is lower, and input and output impedances are lower than in conventional transistors.

Power transistor tests, while embodying the same essential philosophy as those for conventional transistors, must take into consideration these differences in electrical characteristics. For example, the d-c power source for testing a small transistor suitable for use in a hearing aid or radio receiver, low-level stages need supply only a few milliamperes, while 1 or more amperes will be required for the power transistor. The d-c milliammeters and microammeters employed in the testing of general-purpose transistors accordingly must be replaced with ammeters. Similarly, an a-c signal source for the dynamic checking of small transistors furnishes only a few milliwatts at the most, while a comparable source for testing power transistors often must supply 1 watt or more.

Many of the early transistor testing instruments, factory-built or constructed by the user, are unsuitable for power transistors because of a-c and d-c power deficiencies. Suitable new instruments are not appearing on the market in any great number. Expensive, laboratory-grade instruments presently are ahead of service-type testers. Power transistors from many manufacturers now are readily available and are finding application in car radios, audio amplifiers, regulated power supplies, inverters, servo systems, solenoid operation, and motor control. On the heels of this comes the need to test power transistors, either to determine their condition or to verify their characteristics against manufacturer's data.

This article describes several test setups for checking the important characteristics. Polarities shown in the circuits are for PNP transistors. When NPN transistors are to be tested, reverse all power supply, meter, and electrolytic capacitor connections.

Test Precautions

Employ every safeguard to prevent exceeding maximum ratings of the transistor under test. In most instances, maximum permissible current and voltage may not be applied simultaneously without exceeding the maximum power dissipation rating.

Except in temperature studies, tests are made at room temperature (25°C, 87°F, unless specified otherwise). Check the actual ambient temperature and when it exceeds 25°C, apply any derating factor recommended by the transistor manufacturer. Most data tables give power and dissipation ratings both for free air and with heat sink. Dissipation and operating power are higher for the heat-sink condition. When operating at these maximum levels, provide the transistor

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with the heat sink specified by the manufacturer, used forced-air ventilation, or both.

When checking power gain and power output under a-c signal conditions, the test circuit must not be operated without a suitable load device rated to handle safely twice the maximum output power expected.

Because of the high direct current levels involved, especially in checking collector and emitter currents, the ammeters or milliammeters employed must have the lowest obtainable internal d-c resistance to minimize voltage drop across the instrument. A conventional ammeter will be used in most instances and no problem will be introduced, since the instrument resistance will be less than 0.1 ohm. However, some improvised current meters (e.g., a v-t voltmeter adapted for current measurement) have an internal (shunt) resistance of 1 ohm or higher. Such an instrument would introduce a voltage drop of 1 volt per ampere.

Full protection of the test circuit suggests the adequate fusing of supply leads against current overload. However, the resistance of the fuse must be accounted for if it is significant.

All coupling transformers or chokes must be capable of handling the high direct currents without core saturation or damage to the windings.

Static Leakage Current

Static leakage current (also called **cutoff current**) may be measured with the circuits shown in Figure 1. The common-base leakage current, i_{co}, is measured with the setup shown in Figure 1(A), and the common-emitter leakage current, i_{cbo}, with Figure 1(B).

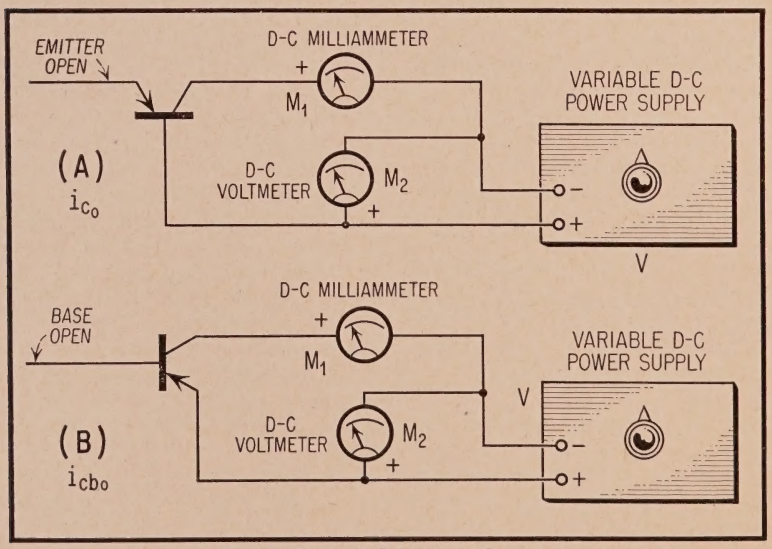


Fig. 1. Static D-C Leakage Current.

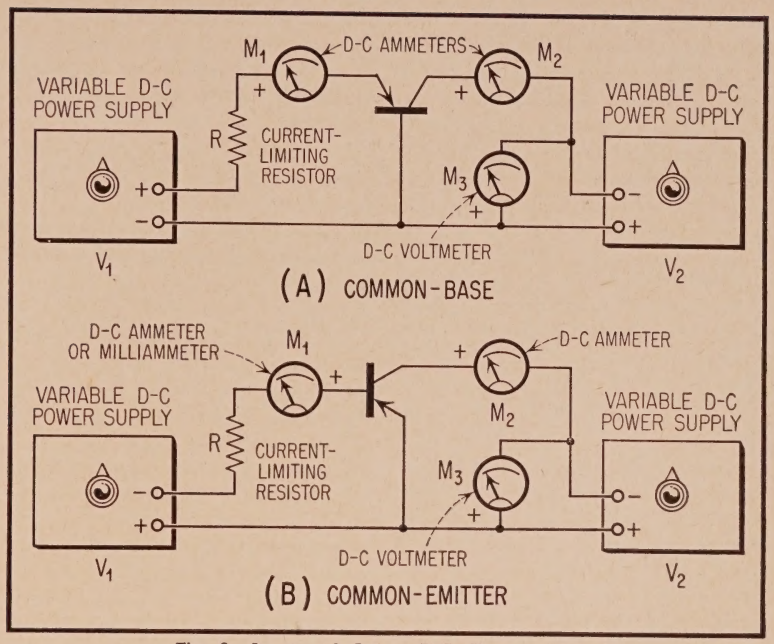


Fig. 2. Input and Output D-C Characteristics.

In each case, the input electrode is left floating.

The d-c power supply voltage, as indicated by M_2, is adjusted to the level at which the transistor is to be operated in its own circuit. The static current is indicated by a d-c milliammeter, M_1.

These tests should be made as rapidly as practicable, since an upward drift of the static current can lead to collector-current runaway which will destroy the transistor. If the ambient temperature is constant and there is no excessive internal heating of the transistor, i_{co} and i_{cbo} should be constant. Drifting or jumping of the current when temperature is constant reveals a faulty transistor. Both i_{co} and i_{cbo} have low values with respect to the normal operating collector current. I_{co} will have a value of several tens to several hundreds of microamperes, depending upon make and power rating of the transistor. I_{cbo} will be from 10 to 50 times higher than i_{co}. The measured values of i_{co} and i_{cbo} should be referred to the transistor manufacturer's specifications. I_{co} will double approximately for each 10 degrees increase of junction temperature.

Input and Output D-C Characteristics

Figure 2(A) shows a setup for checking the input and output d-c characteristics of a power transistor in the common-base connection. Here, a constant d-c voltage, indicated by

M_3, is applied between collector and base. The emitter current, indicated by M_1, then is varied between zero and a selected maximum, and the corresponding collector current values (indicated by M_2) noted. The procedure is repeated at a number of collector voltage steps to obtain data for a family of curves showing i_c vs. i_e for constant v_c. Emitter-current variation is achieved by varying the voltage output of supply V_1. A high limiting resistance, R, permits V_1 to simulate a constant-current supply. Both V_1 and V_2 must be capable of supplying the high direct currents demanded by the power transistor.

Figure 2(B) shows a setup for similarly checking a power transistor in the common-emitter connection. Here, a constant d-c voltage, indicated by M_3, is applied between collector and emitter. The base current, indicated by M_1, is varied between zero and a selected maximum, and the corresponding variation of collector current, indicated by M_2, noted. The procedure is repeated at a number of collector voltage steps to obtain data for a family of curves showing i_c vs. i_b for constant v_c. Because of the inherently high base-to-collector current amplification in the common-emittter circuit, the base current is much lower than the collector current.

Both circuits yield collector voltage-vs.-collector current figures which may be compared with the transistor manufacturer's specifications to evaluate the transistor. If curves are plotted, as suggested above, they may be compared with the manufacturer's curves.

At no time during the test should the maximum permissible values of either collector voltage, collector current, emitter current, or base current be exceeded. Neither should the product $v_c i_c$ exceed the maximum permissible power dissipation of the transistor.

Current Amplification

The setup shown in Figure 2(A) may be employed to measure the emitter-to-collector current amplification factor, alpha; the setup shown in Figure 2(B) for the base-to-collector current amplification factor, beta.

To check alpha (Figure 2A): With power supply V_1 set to zero output, set the collector voltage (indicated by M_3) to the desired operating level for the transistor under test. Next, increase the output of V_1 until the deflection of meter M_2 shows the correct collector current for the selected collector voltage. (This value may be obtained from the manufacturer's data.) Now, increase V_1 to shift the collector current slightly higher than this value, and record this new collector current value as i_{c1}. Record the emitter current (meter M_1) as i_{e1}. Finally, reduce V_1 until the collector current shifts the same amount below the original deflection, and record this value as i_{c2}. Record the corresponding emitter current as i_{e2}. Calculate alpha $= (i_{c1}-i_{c2})/(i_{e1}-i_{e2})$. All current values must be expressed in the same units. Alpha will have a value between 0.95 and 0.98 for most power transistors.

To check beta (Figure 2B): With power supply V_1 set to zero output, set the collector voltage (indicated by M_3) to the desired operating voltage for the transistor under test. Next, increase V_1 until the deflection of meter M_2 shows the correct collector current for the selected collector voltage. Next, increase V_1 to shift the

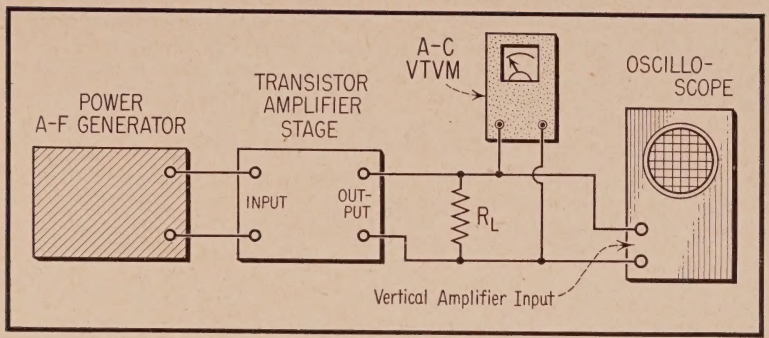


Fig. 3. Power Output.

collector current slightly higher than this value, and record this new collector current value as i_{c1}. Record the corresponding base current (meter M_1) as i_{b1}. Now reduce V_1 until the collector current shifts by the same amount below the original deflection, and record this value as i_{c2}. Record the corresponding base current as i_{b2}. Calculate beta $= (i_{c1}-i_{c2})/(i_{b1}-i_{b2})$. All current values must be expressed in the same units. Beta will have a value between 25 and 50 for most power transistors.

Both alpha and beta may be measured at various collector voltage or collector current levels. All measured values of alpha or beta should be compared with the transistor manufacturer's specifications. Beta decays very rapidly in some defective power transistors.

Collector Dissipation

Collector power dissipation is equal to collector d-c input power minus signal output power. In power output tests, the signal output power is measured in a matched load impedance, and the collector input power is calculated as the product $v_{cc}i_c$. The transistor is delivering power actively to the load. In static tests, however, the collector is called upon to dissipate the entire input power.

In all static tests, the operator must be careful that the product $v_{cc}i_c$, as determined from the deflections of the collector voltmeter and ammeter, at no time exceeds the maximum dissipation rating of the transistor, for the temperature at which the test is made. Excessive power dissipation gives rise to internal heating which, in a circuit such as Figure 1(B), causes the collector current in turn to rise and exceed the dissipation rating still further. The effect is cumulative, is known as **runaway**, and ends in destruction of the transistor.

Power Output

Power output should be checked with the transistor operating in its actual amplifier stage and with its normal signal driving voltage and d-c bias voltages applied. Check the output of power transistors at 1 kc and at as many additional frequencies as are of interest in the proposed application. The amplifier stage should be terminated with a load resistor, the

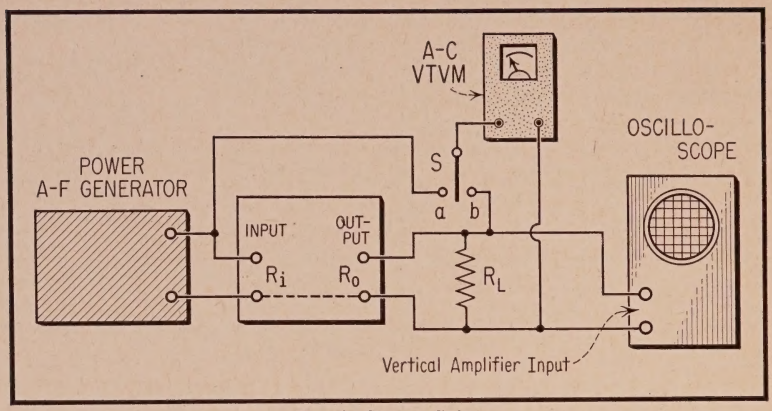


Fig. 4. Power Gain.

resistance of which is equal to the normal output impedance of the stage.

Figure 3 shows the setup for power output measurement. The a-f signal source must be capable of supplying with good regulation the driving power required by the amplifier stage. The oscilloscope permits continuous monitoring of the output-voltage waveform so that distortion may be reduced to a minimum. In this connection, the input-signal amplitude must be held to a level low enough that clipping of the output wave is prevented.

The test procedure is to adjust the input-signal level for maximum output-signal amplitude with lowest distortion, as indicated by the oscilloscope and v-t voltmeter. At this point, the output voltage (E) is read with the vtvm. The output power $P = E^2/R$.

Instead of the v-t voltmeter, an electronic output power meter may be used to obtain direct readings in watts.

Power Gain

Figure 4 shows a setup for checking power gain. This arrangement is similar to the one shown in Figure 3, except that both input and output power are measured and the power gain determined from the ratio of these two values. The power transistor is operated in its own amplifier stage.

The input impedance or resistance (R_i) and output impedance (R_o) of the transistor amplifier stage must be known. The stage is terminated in its characteristic impedance by R_L which is equal to R_o. With the a-f test-signal amplitude adjusted for maximum undistorted output of the amplifier stage, the a-c vtvm is switched first to the input (Switch S in Position a) and its deflection recorded as E_1. Then with Switch S in Position b, the vtvm deflection corresponding to the output voltage is recorded as E_2. Power input $P_i = E_1^2/R_i$, and power output $P_o = E_2^2/R_o = E_2^2/R_L$. Power gain (PG) $= P_o/P_i$. To express the power gain in db, PG $= 10 \log_{10}(P_o/P_i)$.

In both power-test setups (Figures 3 and 4), any transformers in the amplifier circuit must be capable of

handling safely the high direct currents of the power transistor. In a Class-A amplifier stage the steady d-c collector current flowing through the primary winding of the output transformer will be between 150 ma and several amperes, depending upon transistor type. The secondary winding of the input transformer must handle between 5 and several hundred milliamperes.

Transistor Resistances

Power transistor resistance parameters may be checked with the setups given in Figures 2 and 5.

Input Resistance, Common-Base. See Figure 5(A). Input resistance (R_{11}) is the slope of the curve showing emitter voltage (read with M_2) vs. emitter current (read with M_1) for constant collector current (read with M_3). To obtain the points for the curve, set the emitter current, by adjustment of supply V_1, successively to a series of test points. At each point, set the collector current to the same constant value by adjustment of supply V_2, and read the corresponding emitter voltage. For a family of curves, repeat at selected values of constant collector current.

Input Resistance, Common-Emitter. See Figure 5(B). Input resistance (R_{11}) is the slope of the curve showing base voltage (read with M_2) vs. base current (read with M_1) for constant collector current (read with M_3). To obtain the points for the curve, set the base current, by adjusting supply V_1, successively to a series of test points. At each point, set the collector current to the same constant value

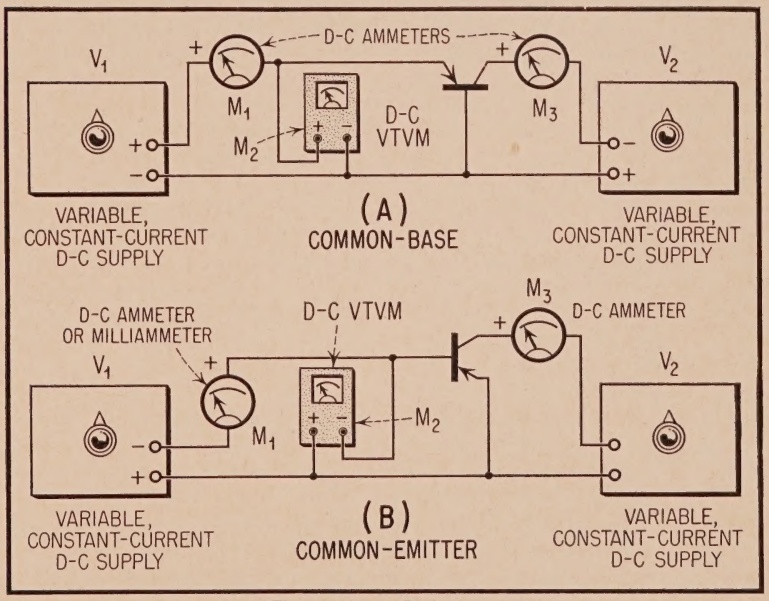


Fig. 5. Input Resistance.

by adjusting supply V_2, and read the corresponding base voltage. For a family of curves, repeat at selected values of constant collector current.

Output Resistance, Common-Base. See Figure 2(A). Output resistance (R_{22}) is the slope of the curve showing collector voltage (read with M_3) vs. collector current (read with M_2) for constant emitter current (read with M_1). To obtain the points for the curve, set the collector current, by adjustment of supply V_2, successively to a series of test points. At each point, set the emitter current to the same constant value by adjustment of supply V_1, and read the corresponding collector voltage. For a family of curves, repeat at selected values of emitter current.

Output Resistance, Common - Emitter. See Figure 2(B). Output resistance (R_{22}) is the slope of the curve showing collector voltage (read with M_3) vs. collector current (read with M_2) for constant base current (read with M_1). To obtain the points for the curve, set the collector current, by adjustment of supply V_2, successively to a series of test points. At each point, set the base current to the same constant value by adjustment of supply V_1, and read the corresponding collector voltage. For a family of curves, repeat at selected values of base current.

Temperature Coefficient

Each of the transistor parameters exhibits some sensitivity to temperature. In applications in which transistorized equipment must operate at elevated or reduced temperatures, it is necessary to determine the extent to which these parameters vary.

To study the effect of temperature on a particular electrical characteristic, use the applicable test setup from Figures 1 to 5. Mount the transistor solidly inside an adjustable temperature chamber, bringing the leads out from the base, collector, and emitter terminals to the external test circuit.

In tests involving a series of temperature levels over a given temperature range, measurements should be made at all points descending, as well as ascending the temperature scale. Any variations in figures obtained at the same temperatures indicate hysteresis effects. A plot of the data will have the characteristic two-route shape of the hysteresis loop.

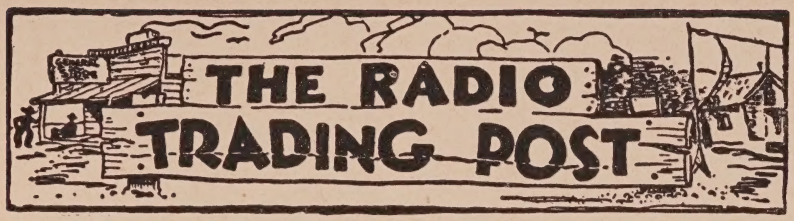
Operating Temperature

Unlike their low-powered counterparts, power transistors generate appreciable amounts of heat during normal operation. If the operating temperature becomes excessive, the d-c input must be reduced. Transistor manufacturer's data specify maximum temperatures.

The operating temperature of a power transistor should be checked with thermocouples attached to the metal envelope of the unit. The thermocouple must be measured with an accurate millivolt potentiometer.

Matching

For maximum power output and minimum distortion, power transistors which are to be used in pushpull stages should be matched. The main characteristics to be matched are static leakage current, current amplification, collector current, input and output resistance, and power gain. When only the minimum of matching operations can be permitted, static leakage, current amplification, and collector current are suggested.



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WANTED — Lafayette LT-20 FM-AM tuner; LA-66 35 w. amplifier; pocket size FM and AM radios. Oliver A. Zucco, Granite Ave. Ext., Canaan, Conn.

SELL OR TRADE — Sylvania 216 AM-FM all freq. gen., l. n., and 500 TV sweep gen., l. n., Radion FSM-5000 UHF-VHF field strength meter used very little, battery operated. Need good comm. rcvr. R. T. Whitaker, Bishop, Texas.

WANTED — Vacuum capacitors, fixed and variable, blank LM frequency meter book, BC-625. Items available to trade. H. E. Decker, 1 Queens Ct., Huntington 5, W. Va.

FOR SALE — Like new, Century in-circuit condenser and resistor analyzer, $10; TV-11 Superior tube tester, up-to-date roll chart for all tubes, perfect cond, $40. E. L. Oxford, 1855 So Fed Blvd., Denver 19, Colo.

SELL OR TRADE — 12KP4A and JAN. 3AP1 tubes. Make offer. Can use 6 v. dynamotor. C. B. Kelley, 7204 Clovernook Ave., Cincinnati 31, Ohio.

SWAP — Hallicrafter S-38 excellent cond. for FM tuner or FM tuner kit. Stanley Harney, 290 Blake Ave., Brooklyn, N. Y.

WANTED — Have cash for set of coils 27-30 Mc band for HR05. State cond. and price. E. Joseph, 6062 71st Ave., Ridgewood 27, L. I., N. Y.

SWAP — Complete ham station: National rcvr., Hallicrafter bandswitching transmitter, accessories for old classic car. Prefer open touring Packard, Cadillac, or Pierce Arrow, etc. Must be complete and driveable or repairable. R. A. Bost, 628 Selma, Poplar Bluff, Mo.

WANTED — Hickok or Precision test equip. in trade for shop tools. Hugh G. Stacey, 4 Dartmouth St., Natick, Mass.

HELP WANTED — TV, small appliance, refrigerator, and motor repairmen. Full or part time. Newton Centre Radio Shop, 759 Beacon St., Newton Centre 59, Mass.

WANTED — Late RCA home study TV or NRI Tops in TV Servicing courses. Give details and prices. E. P. Riffle, 9109 49th Ave., College Park, Md.

WANTED Camp counselor — man to handle ham radio shack at co-ed summer camp. Must be over 20, and have general license. Camp in Berkshire Area. Write full details to Norman B. Weingrow, Stissing Lake Camps, 70 Stratton Rd., Scarsdale, N. Y.

WANTED — Early model AC-DC table radio in working cond. Send complete information and price. David Klaiber, Lincoln Ave., Hamburg, N. Y.

SELL OR TRADE — DM-35 12 v. dynamotor for 625 v. out at 200 ma. Have others for 12 and 6 volts; commercial pi-net inductor for KW xmitter, other parts and tubes. Dick Bolt, Room 201, SHR, Worchester Tech, Worchester, Mass.

WANTED — Radio-control equip. for model planes. Steele Radio & TV Service, R 1, Shelbyville, Ind.

FOR SALE — Complete amateur station, fone and CW, HT9 all coils, spare parts, EX Meissner sig, shifter; SX28 rcvr., and speaker; RME 45 and speaker and HF 10-20 converter. Lew Saunders, 67 Webber St., Battle Creek, Mich.

FOR SALE — Unused AW surplus Esterline-Angus recorder range 0-1 milliamutes $\frac{3}{4}$-1-$\frac{1}{2}$-3-6'' factory seal intact, pere. Feeds hourly $\frac{3}{4}$-1-$\frac{1}{2}$-3-6-12'' min- $175 FOB. Joseph D. Ogle, 304 Bushy Hill Rd., Simsbury, Conn.

FOR SALE — Heathkit test equip., used 6 months: 0-10 scope and probs, $55; SG-8 sig. gen., $15; T-3 sig. gen., $18; TS-4 TV alignment gen., $42; LPI linearity pattern gen., $18. All for $140. Larry Mortensen, Box 388, Babbitt, Nev.

FOR SALE — Late model tube and set tester, never used, $25; CRT reactivator, $20. Both for $35. Will ship anywhere on receipt of cash or M.O. Joseph Harrison, 689 Clinton Ave., Albany, N. Y.

TRADE — Heath AT-1 transmitter modified 40-45 w.; S-38C Hallicrafters rcvr. Trade both for working transmitter over 50 watts. Harold Parks, 122 N. Maryland Ave., Atlantic City, N. J.

SELL OR SWAP — Philco RF sig. gen., good cond. Need photo exposure meter, FM tuner, or? H. Cohen, 1975 83 St., Brooklyn 14, N. Y.

FOR SALE — Good 16CP4 pix tube, $10.50; approved A-460 Electronics Instrument Corp. field strength meter, used very little, $35. No trades on meter. Want good Lionel train. L. E. Smith, R 1, Trion, Ga.

SELL OR TRADE — Mallory UHF converter, FM tuner and 2 cascode tuners for cash or 12 size Studebaker 21 j watch or TV tubes. J. W. Landon, Wayne, W. Va.

WANTED — Radio noise filters, list manufacturer, type, current, voltage, lowest price. John Lopes, Box 558, New Bedford, Mass.

FOR SALE — 27'' console TV, $250 or best offer; Heath W 5M amp. and SS-1 spkr, $125; Heath scope and RF probe. Will ship upon receipt of payment. G. E. White, 17602 Van Buren, Huntington Beach, Calif.

SELL OR SWAP — AC and DC meters, AC motors, Petro oil burner, heavy chisels, star drills, saws, socket wrenches. Want electronics test equip. A. Keidanz, 1351 Boynton Ave., Bronx 72, N. Y.

WANTED — 110 v. light plant or inverter. State price or will swap for radio-TV parts and equip. Eddie's Radio-TV Ser., 1308 N. Leavitt St., Chicago 22, Ill.

FOR SALE — Meissner 8C. FM tuner, good cond., (88 to 108 Mc.), $20; vol. 13 Riders, 1. n., $10. Ira L. Lee, Henagar, Ala.

FOR SALE — Unused Knight kit FM tuner, completely assembled and aligned, $45. Raymond Carl, 1111 Vance Ave., Coraopolis, Pa.

SELL OR SWAP — Viking 1 xmitter, completely TVI'd; mobile xmitter Hallicrafter rcvr.; Bogen inter-com; wire recorder. Need test equip., power tools, camera, hi-fi components. Dave Siegel, 130-18 223rd. St., Laurelton 13, N. Y.

FOR SALE — NRI 1175A, all-purpose radio set tester, with multi-meter section and RF all-wave sig. gen. section, battery operated, $10. Samuel F. Chase, 20 Brookside Ave., Somerville, N. J.

SWAP OR TRADE — Ernemann camera, 4.5 x 6 cm., Zeiss Jena Tessar F4.5, plateholders, excellent cond., for binoculars, ham equipment, typewriter, or what have you? J. Calder, 6351 Oakland St., Philadelphia 49, Pa.

FOR SALE — Back issues of IRE Proceedings to 1952, all or in part. Make offer. Ed G. Raser, 315 Beechwood Ave., Trenton 8, N. J.

FOR SALE — Red Motorola portable radio, less batteries, 3-way, $15. Tom Karakis, 1316 So. 49th Ave., Cicero 50, Ill.

WANTED — One or all speckers used in Electro-Voice Patrician. Fred Butterfield, 1 Second St., Brooklawn, N. J.

WANTED — Broad-banded rcvr. for monitoring 29.493 Kc. C. L. Stouth, Box 44, King of Prussia, Pa.

WANTED — Late model HRO, super-pro NC183D or NC183 rcvr. in top cond. Give details and price. C. F. Gramm, 869 Whalen Rd., Penfield, N. Y.

TRADE — DeVry sound projector 16 mm, for SW rcvr. or record changer. E. A. DeCobert, Jr., 609 Henrietta St., Gillespie, Ill.

FOR SALE — Sams Photofacts 12 thru 243; DeForest training course with kit instruments; 21 manuals including 5 Riders; Sen. voltohmest with high voltage probe; tube caddy; 3" oscilloscope, sig. gen, $350 or best offer. Larry A. Williams, Box 270, East Liverpool, Ohio.

FOR SALE — 10 w. 80 meter CW xmitter. with built-in keying monitor, power supply, plate milliammeter, $12. E. P. Sadler, 398 Sigourney St., Hartford, Conn.

FOR SALE — Hickok 292X Microvolt gen., 125 Kc to 220 Mc. Complete, l. n., $200. Edward B. Carnahan, Box 374, Placerville, Calif.

WANTED — Electro-Voice model 3005 FM booster. State cond. and price. Geo. A. Cahill, East Dennis, Mass.

WANTED — "Short Wave Craft" magazines 1930 to date. Name your cash price for complete library or single issues. Also ARRL Handbook vols. 2-6. Bob Jones, 713 Front St., Catasauqua, Pa.

TRADE — University 6201 coax hi-fi spkr. with crossover control in reflex baffle, for HO gauge electric trains or hunting rifle of 270 or 30-06 cal. A. Alcamo, 67 Stewart St., Brooklyn 7, N. Y.

FOR SALE — Grommes 10 w. Hi-Fi amp., $20; Eico 221 VTVM, $15. Prefer local. A. Kinge, 235-73rd St., Brooklyn 9, N. Y.

FOR SALE — Precision sig. gen. E-200-C, slightly used, $70, plus shipping. S. D. Hoffman, 5019 Minden Rd., Memphis 17, Tenn.

WANTED — Hickok 288X sig. gen., in perf. condition. State best cash price. F. C. Davis, 43 Rivermont Drive, Warwick, Va.

WANTED — Navy type RAL regenerative receiver. R. H. Holsclaw, 2912 East Mabel St., Tucson, Ariz.

SELL OR SWAP — 500 w. antenna tuner all bands; audio transformers, power supplies, for S38 or S40 rec.; ratio-meter SWR or Heath reflecter power meter kit; B&W TR switch or similar. H. E. Leigh, Sr., 828 Nevada Ave., San Jose 25, Calif.

WANTED — BC-946 receiver in orig. condition or Navy version of same receiver. Harvey Van Erem, R. 1, Box 92, Jamestown, North Dakota.

WANTED — Back issues of Sams Photofact Reporter, complete set to date. Pat Blaney, New Straitsville, Ohio.

FOR SALE — Ballantine Labs. precision sensitive inverter model 700. Inverts dc input voltage to RMS voltage in ratio of 1:100 and 10:1 for a range of 10 microvolts to 100 vdc. Accuracy 1%, $250 fob. Satisfaction guaranteed. E. Backstrom, Jr., 5235 N. Winthrop Ave., Chicago 40, Ill.

FOR SALE — TV Precision sweep gen.; Sylvania marker gen.; over 300 TV tubes. Both units never used. Best offer. A. E. Lopes, 77 Mountfort St., Boston, Mass.

SWAP — BC-683E narrow band FM rcvr., 27 Mc. to 39 Mc. complete with tubes. Want ham electronic gear. Alfred Isaacson, 3610 Sunnyside Ave., Chicago 25, Ill.

WANTED — "Armature Winding" by Terrell Croft, also instruction book for Vomax 900 electronic voltmeter. Malcolm S. Cone, 1525 Vinton Ave., Memphis 4, Tenn.

SWAP — Want small electronic organ, trade for ham gear, other electronic equip. Give particulars on organ. J. Stantley, 521 Bloomfield Ave., Newark 7, N. J.

WANTED — Position in the electronic field. Interested in Viking Ranger xmitter with Q multiplier — cash or trade. Walter Ahern, 55-37-84th St., Elmhurst 73, N. Y.

FOR SALE — Husky 3-element pretuned 10 M aluminum beam: low Q 1.66" diameter element centers and boom, 20' boom adaptable to 5 elements or for 15, 20, or 3-band job, quickly assembled. Sell for half cost of materials, $32, shipping extra. J. P. Neil, 372 Rincom Ave., Livermore, Calif.

WANTED — Candler System High Speed Telegraphing Course (advanced), in good cond. Name rock-bottom price for cash. H. Butterworth, 2708 Gaither St. SE, Washington 21, D. C.

FOR SALE — Recent complete DeVry radio and TV course, in good cond., $50. Fred Scheider, 18 Marshall St., Apt 8U, Irvington 11, N. J.

WANTED — TM-11-300AG War. Dept. technical manual for SCR 211 frequency meter sets for use in technical institute communications lab. W. H. Anderson, 50 Gould St., Toronto, Ontario, Canada.

WANTED — Courses on appliance repair, refrigeration, and air cond. Will pay cash. Give age, cond., price. Robert E. Wall, Box 141, Byars, Okla.

FOR SALE — Viking II, practically new, $185; BC-221 freq. meter, model AH with calibration book and tech manual, $65. A. Magel, 115 Rockaway Ave., Rockaway, N. J.

TRADE — Voigtlander-Bessa camera with case; Bogen 6 w PA with mike for Heathkit AM tuner; 30-50 Mc. FM converter or what have you? R. Parris, 29 Charles St., Natick, Mass.

WANTED — Two-way radio communication equip., all frequencies including 70 Mc units, also especially interested in 150 Mc gear in single or quantity lots. Must be priced for resale. Fitzgerald Communication Service, 211 South St., Minden, La.

FOR SALE — 19 miscellaneous Sam's Fotofacts each with one diagram missing, all for $5 or 50c per set; Johnson 70ED45 variable condenser, 1. n., dual 73 mmf., $5. Gerard A. Baldauf, 3137 Philmont Ave., Huntingdon Valley, Pa.

SELL OR TRADE — Kay bass cello, bow, case (worth $400) for $200 cash, or combination TV-radio-phono set. Prepaid express. Dan Bruno, 28 S. Bow, Milford, Mass.

WANTED — Vocaline used units. Have Shure mike, Century ant; chk, 30-50 FM tuner, for cash or trade. R. C. Westfall, Underwood Trailer, Rt. 88, Portland, Me.

FOR SALE — Gonset 3-30 meg. converter, $20; Lysco 10 meter mobile phone xmitter and mike (carbon), $12; 300 v. vibrator power supply relay operated, $10. All in good cond. Lowell Wilson, 5061 Emerson Ct. S/Dr., Indianapolis 18, Ind.

FOR SALE — Precision E200C; Sprague KT1 condenser checker; Heath V6 with HVP; Heath tube checker with CRT adapter; DeVry TV course without kits. Best cash offer. H. E. Pence, 10th Ave. So., Attalla, Ala.

FOR SALE — B and W KW coils for 80, 20, and 10, $10; also CX95C butterfly; National 500A neutralizing; Gonset twin 6 harness $3.50; 522 xmitter modified with power, complete, $35. Want 300-500 w. modulation xformer. Hopper's Radio Shop, 301 Hollis St., Framingham, Mass.

SWAP — Knight sig. tracer, for either Eico or Heath sig. tracer, or what have you? Walter J. Williams, 1215 Adams St., St. Clair, Mich.

TRADE — Wilcox-Gay portable disc recorder operating on citizens band, such as Stewart-Warner Portafone system, for pair Walkie-Talkies. Sell dynamotor, input 18 v., output 450 v., $4. Charles Bray, Frakes, Ky.

FOR SALE — RME Mc. 55 mobile converter, $40; DX-35 and Heath VFO, $60; Micamold XTR-1 80-40-20 meters 40 w. CW 110 v. AC, $25. All FOB. Joe Coffield, 1731 West First St., Brooklyn, N. Y.

FOR SALE — DX-20 xmitter, excellent cond., $30; Navy DY-9/ARC-1 dynamotor. Best offer. Chester Britz, 349 Fabyan Place, Newark, N. J.

WANT — Sams Photofacts in complete sets in quantiy for 50c a set, must be clean. Send list. Urgent: PF Reporters, Aug., Sept., and Nov. 1955 in good cond. J. Kolocotronis, 751 Syracuse Ave., University City 5, Mo.

FOR SALE — Three I-122 sig. generators in oak carrying case; 15-25 Mc. 95-125 Mc. bands with piston attenuator 1 to 100k microvolts, $40 each. Leo Wiman, 6418 Woodland Dr., Dallas 25, Texas.

FOR SALE — Good BC459A, 40 meters, converted to 6 v., plate and grid meters, $12. Needs 2 807 tubes. J. Grubbs, 208 Taylor St., Barnesville, Ga.

TRADE — VHF converter; 30X telescope on tripod; 33⅓ record player in case; VO meters. Need velocity mikes, 2-meter gear. N. B. Bowerman, 1520 Plank Rd., Jeffersonville, Ind.

FOR SALE — Riders vols. 9-22, $40. Lewis H. Wilson, 206 Public Square, Berryville, Ark.

WANTED — 2¼ x 2¼ Reflex camera, single or double for cash or trade Radio-TV equip. Roy Ragan, 2700 Park St., Rolling Meadows, Ill.

FOR SALE — Riders vols. 15, 16, and 17, $15; G.I. recorder-phono assembly (33⅓ and 78 rpm), $25; Harvey-Wells ATR-3 12 v. aircraft transceiver, $52.50. Herman's Radio Service, 803 W. Locust St., Bloomington, Ill.

FOR SALE — RME-45 with speaker, $75; Knight 50 w. xmitter, $30; Eldico TR-75TV (4) xmitter, $35; Eico factory-wired gegier counter, $20; Weston 6½" 0-30 AC ammeter; Federal 1925 59 rcvr. John Bradley, 72 High St., Montclair, N. J.

SELL OR TRADE — 90 panel meters; chrome hand tools; VOM's, tubes. Want scope, FM rcvr, 8BP4, and 11M48. Roby's Swapmart, 2422 N. Halsted St., Chicago 14, Ill.

FOR SALE — Receiver BC 348Q converted to 110 VAC, excellent cond., $45 cash only. G. S. Garrigan, 357 Plymouth Rd., Union, N. J.

FOR SALE — Complete air conditioning course — 75 lessons by Air Conditioning Training Co., Inc., Cost $300. Make offer. Henry A. Kuck, 245-05 Union Tpk., Bellerose 26, N. Y.

WANTED — Signal Corp. surplus xmitter, type 250 GSC made by Temco, 250 w. State price or trade. V. Barker, Woodside Dr., Freeport, Ill.

FOR SALE — Radar rcvr.-xmitter, surface search, shipboard use, pulse type signal, 115 VAC, 24 VDC. Includes NT-46ACA-1 rcvr., HV pulse trans. magnetron osc., Klystron osc., TR. box blower motor. Make offer. R. H. Schmeling, 2916 South 60th St., Milwaukee 19, Wis.

WANTED — FM tuner, record changer. Offer cash or Kodak Pony 35 mm camera. H. F. Heath, Jr., 10 Kinry Rd., Poughkeepsie, N. Y.

FOR SALE — Unused Freed transformer, 2000 VCT @ 700 Ma and Eimac 4-65 A's; NC-46 rcvr., 1. n.; klystrons, magnatrons, etc. Rich Wujciak, 43 Oak Ave., Irvington, N. J.

SELL OR TRADE — Precise 630 Rf-Af sig. gen., needs calibration, $30; pair of wired selsyns, $5. Want Heath A-7D or E amplifier in any cond., reasonably priced. Bruce Sanderson, 1553 E. Lincoln, Birmingham, Mich.

WANTED — Electro-Voice T25A drives, 8HD horn, AT35 level control, for cash. Jerry Dachs, 1687 Macombs Rd., New York 53, N. Y.

SWAP — 50,000 feet coax wire, for test instruments or Sams TV folders. Jacks Shop, R 1, Lewisburg, Pa.

FOR SALE — Local preferred. AR-320 multimeter with 3" scale, new import, $17. Gene Mick, 515 Buxmont St., Philadelphia 16, Pa.

FOR SALE — 1919-29-33-48-QST; 1930-31-51-50-53-CQ; 1949 to 1956 C-D Capacitor. A. C. Scofield, 119 So. 23rd St., La Crosse, Wis.

WANTED — Adaptor for 7" CRT testing. Mfgd. by Oak Ridge Products, for model 106 "Cathette" tester. H. Parker — Radiotrician, 522 Sandusky St., Pittsburgh 12, Pa.

FOR SALE — Disc recorder, new gen. ind. (GI-R85L-LP) with 10 ohm magnetic head. Cost $35, sell for $10 FOB or COD. J. Hogan, 4757 Montgomery, Millington, Tenn.

WANTED — Back issues of Audio, Ampex 620, Waterman S-111A Industrial scope, disc recorder. Cash or swap RCA WV-95A, Pickering fluxvalve, B and W freq. meter, UST sweep gen. TVFM. R. Streeter, Highlands AFS, Highlands, N. J.

WANTED — Microscope. Swap radio tubes and hi-voltage probe and radio parts. John J. Conroy, 2523 W. Willard St., Philadelphia 29, Pa.

SELL OR SWAP — Model 950 B and K Dyna-Scan RF unit in factory sealed carton, $50 or trade for B and K 350 CRT rejuvenator tester or modern mutal conductance tube tester. Al Roark, 762 West G. St., Ontario, Calif.

FOR SALE — Voltage stabilizing transformer, 120 KVA, 95 v. to 130 v. input, 120 v. output, $30; magnetic amplifier, 115 v. 60 cy, .20 amp DC output, $15, all FOB. Harold Bowman, 1724 Grandin Rd. SW, Roanoke, Va.

WANTED — Used test equip. in good cond. for mobile radio service work. Cherry Radio Co., Inc., 1438 Belfield Ave., Philadelphia 40, Pa.

WANTED — Sams Photofacts from 349 up. Will pay $1 each plus freight. O. B. Hasson, 17824 S. Clark Ave., Bellflower, Calif.

SELL OR TRADE — Kine exacta camera; 8 mm B and H movie camera; Kodak 35, for hi-fi set, FM radio, TV set or ham equip. John Laflie, 6146 S. Kenneth Ave., Chicago 29, Ill.

WANTED — Hi-fi components: transformers, amplifiers, speakers, changers, tape recorders; communication rcvr; grid dip oscillator, AM and FM tuners. Cash or trade. A. C. Livingstone, 12-01 Ellis Ave., Fair Lawn, N. J.

TRADE OR SELL — VHF rcvr. BC-522, less tubes, $9; Hallicrafters S-38-C, $20; Welder's gauges on regulator, $10; photo or radio magazines 12 for $2. FOB. Gene Brizendine, 1001 Merritt St., Old Hickory, Tenn.

WANTED — Vol. I RCA Pictoguide in good cond. State price. Joseph Gontarz, 14 Rudolph Rd., Forestville, Conn.

WANTED — Old Duck, E. I. Co., or similar loose coupler, vintage around 1920. State price, cond., etc. Llyle Roderick, 408 E. Shorb St., Alhambra, Calif.

FOR SALE — Dumont-Clifton 12" TV, regulated power supply B+ relay; AM and FM radio, $50. Ted Duzak, 807 So. 16 St., Newark 8, N. J.

WANTED — Schematic, Tech. manual or conversion data on BC348C converted to BC348S. Cash for worthwhile information. Morris D. Gottesman, 1711 Mohican St., Philadelphia 38, Pa.

TRADE — Sig. gen; VOM; condenser checker, all for tape recorder. Emory Corron, 4096 Redonda Lane, Dayton 16, Ohio.

WANTED — Manual or information on Tiffany Tone radio-rcvr. chassis no. 518-CA51870, reasonable price. Prefer schematic of wiring and parts listing. Lynch Radio & TV, 2149 Island Circle, Grand Prairie, Texas.

WANTED — Eico colorscope or Hickok or Dumont DC scopes; Phaostron multimeter; 50 w. hi-fi amplifier; Heath distortion meter; universal impedance bridge; South Bend lathe; 24 v. or higher battery charger; capacitor and resistor decades. M. Larou, 215 Randolph St., Passaic, N. J.

FOR SALE — Complete SSB station. rcvr.: NC-183D; xmitter: Central Electronics 10-A, factory-wired, with anti-trip unit. 80, 40, 20, 15, and 10 meter coils. Sidney Kaplis, Box 222, Stratford, Conn.

WANTED — Heath, TS-4A sweep gen., any cond. State price and cond. Howard Newcombe, Box 528, Myrtle Creek, Ore.

WANTED to buy — Good capacitor tester factory wired or tested. Virgil Kramer, Box 834, Burwell, Neb.

SELL OR SWAP — Unused 77" inclosed relay rack, other table racks, xmitting and special-purpose tubes, meters, lab and ham equip. Want tubes, ham rcvrs. and xmitters, etc. B. Gensler, 512 Broadway, N. Y. C.

WANTED — 17 HP4 pix tube and slide projector. Trade Radio-TV course less kits or pay cash. E. A. Sawyer, Box 146, Marshall, N. C.

FOR SALE — Converted 80 M and 40 M Command rcvrs., $10; code xmitters, $5 and $15; code/fone, $15; National SW-3, $20; l. n. BC-342P, $80; other units. P. Borri, Box 14, Hamilton, Mich.

SELL OR TRADE — Wards AM-FM, phono comb. table radio, needs repairs; David Hall record book. Want tube tester or what have you? Vincent Malack, 10530 Edbrook Ave., Chicago 28, Ill.

SWAP — RCP 777 sig. tracer with meter and speaker in good cond. Want Japanese or US Army type binoculars 7 x 50 power individual focus 376 ft x 1000 yards or better. Rupert Freeman, 2108-33 Ave., Meridian, Miss.

FOR SALE — BC-221-B frequency meter with crystal and calibration book. Ralph F. Miller, Front St., Flat Rock, Ill.

FOR SALE — Unused Leitz Prado 300 w. projector. Discount from purchase price. Frank F. Fiebiger, Montpelier, N. D.

FOR SALE — Auto radio, l. n., deluxe Mopar 835 "Musicmaster" for C-67, -68, -69, 1955 Chryslers, push-button tuning. Original custom Chrysler installation. F. Idoni, 216 Fir St., Valley Stream, N. Y.

FOR SALE — Motorola 2 meter, 10 w. 2 frequency mobile FM rig, with all accessories including xtals for 147.3 and 147.5 Mcs, for 6 v. operation, l. n.. Best offer. F. J. Clark, 6605 Northwest Hwy., Chicago 31, Ill.

WANTED — BC-348, and 342 rcvrs., parts, xmitter tubes, test sets, aircraft, marine, and ham gear, tape recorders, tech manuals. Bill Slep, Box 178, Ellenton, Fla.

WANTED — Scope in good cond.; TV sig. gen. or marker; VTVM. State cond. and price. Ezell's Radio, 2800 Downing St., Denver, Colo.

WANTED — Recording tapes for Hartron 980 recorder manufactured by Daystrom. Burtchaell Research Service, 64 Prospect St., Trenton 8, N. J.

FOR SALE — Two Presto 3-speed T-18 Pirouette 12" turntables, in unopened original cartons. Best offer over $55 each. Vic Lapish, 766 Elmwood Ave., Jackson, Mich.

FOR SALE — Transmitter in Bud 37" cabinet; 250 w. phone, PP 812's modulated 809's; power supplies 1200 and 750 v. $95 or what will you trade? Bill Lamb, 802 Potter Lane, Nashville 6, Tenn.

FOR SALE — Viking I with Meissner Ex sig. shifter, TVI'd, $150; parts, tubes, test equip., BC312, BC221, Hickok 3" scope, 4-250A, 100TH, 250TH. Want Mon-Key electronic key. N. K. Stover, 1357 Hill St., York, Pa.

SWAP — 40 ft. RG-9 coax and DPDT 110 v. relay, for cash or bug in good cond. Robert Winston, 73-39 188 St., Flushing 66, N. Y.

WANTED — Unbroken dark brown plastic case for RCA X-551 table model radio. Melvin G. Neeley, 1128 13th Ave., Sacramento, Calif.

FOR SALE — Hallicrafters S72 portable communications rcvr., $45; 30-50 Mc. FM police-alarm rcvr., $25, plus shipping charges; QST 1951-1957. Terry Bateman, 1622 Springwood Ave., Olympia, Wash.

WANTED — Transcriptions and records from 1930-40, $5 each. James Orlando, Dickerson Run, Pa.

FOR SALE — Over 400 copies of QST starting in the 20's, $55 plus freight. C. D. Ferguson, 258 Home Ave., Graham, N. C.

FOR SALE — RCA WF16A geiger counter with earphone, meter, slightly damaged, $80. H. R. Clark, 243 Maine Ave., Erlton, N. J.

FOR SALE — NRI professional TV servicing course complete with 17" TV set, scope, and sig. gen., l. n., $90; Coyne Applied Practical Radio-TV l. n., $18 prepaid. William M. Cooper, 700 E. 2nd. St., Siler City, N. C.

SELL OR SWAP — TV test equip., books, parts and schematics. Interested in tape recorder, photo. W. W. Brock, 866 W. 38th St., Norfolk 8, Va.

SELL OR TRADE — Tubes: 1-7JP4; 4-3B24; 1-C6J; 2-810. What have you? Edgar C. Lewis, Hobbsville, N. C.

TRADE — 16 mm motion picture film on 100 ft spools, for photo or electronic equip. C. J. Stahnke, 5565 N. Federal Blvd., Denver 21, Colo.

WANTED — TVI high-pass filter and low-pass filter for 50 ohm coax. Leo P. Lastuvka, 1044 19th St. SE, Cedar Rapids, Iowa.

FOR SALE — Precision, series 920 tube tester-multimeter, perfect cond., roll chart, all accessories, $40. D. Bonvallet, 742 Bellevue, Milford, Mich.

FOR SALE — Bendix AC-DC airplane gen., 30 v., 75 amps DC, 1200 w., 800 cy AC, $15; 1/3 hp 3500 rpm 120 v., 5/8 shaft lawn mower motor, $8; Heath O-8 scope with leads and manual, l. n., $30, FOB. G. E. Buske, 717 Moores River Dr., Lansing 10, Mich.

FOR SALE — 9T3M Pentron tape recorder deck with instructions and preamp, information, slightly used, $25. John F. Petters, 6360 Bryant Rd., Ludington, Mich.

WANTED — VTVM, log-log slide rule, Rider's "Basic Electricity," "Basic Electronics" and "Basic TV." Describe and state price. H. M. Denison, 1212 Central Ave., Columbia, Pa.

SELL OR TRADE — Merit HVO-35 horizontal output flyback transformer, in original carton; 7" Motorola model VT71M-A. Make offer. M. J. Lacharite, Bryant St., Ironia, N. J.

SELL OR TRADE — 7½ hp Elgin outboard motor for cash, tape recorder, FM tuner, ham equip. Frank J. DiLustro, 204 Van Sicklen St., Brooklyn 23, N. Y.

SELL OR TRADE — Like new Philmore RC-333-T radio control xmitter and escapement; Teletrol R-272A radio-control rcvr., 27.255 Mc. Want ham rcvr. or offer over $45. George Maxey, 945 Lincoln St., Redding, Calif.

TRADE — Binoculars 7 power 50 mm with leather case and shoulder strap. Best offer or 5" wide band scope, TV alignment gen. A-1 cond. F. J. Comeford, R-3, Box 19, Valparaiso, Ind.

SWAP — Polaroid 110 camera, 1/400 sec. f/4.5 lens, with adaptor and instruction manual, perfect cond, for Minifon midget wire recorder in perfect cond. and accessories. E. J. Dereg, 82 Belle St., Springfield, Mass.

FOR SALE — Heath DX-35 xmitter for 80, 40, 20, 1. n., $50; Philco: 5" scope, rack mounted, $30, FM xmitter 71.75 Mc., $20, sig. gen., $15. Peter Frank, 26 Edgewood Rd., Yardley, Pa.

WANTED FOR CASH — Used Precision E-200-C sig. gen., complete with cables and book. State price first letter. Charles G. Williamson, 1217 Lyman Pl., Los Angeles 29, Calif.

FOR SALE — Complete 2-meter xmitter, 65 w. input, push-pull 6L6 mod. suppressed TVI, all in metal cabinet; 4 tube XTL converter with BC-455 rcvr. Speaker, phones, XTL mike, ground plane ant., $85. Harry Weintraub, 199 Zabriskie St., Jersey City, N. J.

WANTED — Vol. 4 Rider's; sine-wave and square-wave sig. gen.; intermodulation distortion analyzer; harmonic distortion and noise meter; WOW and flutter meter; stylus microscope; AC VTVM. J. Weissner, 72 Truesdale Dr., Croton-On-Hudson, N. Y.

SELL OR TRADE — Cardmaster post card printing outfit, complete. Want good hi-fi speaker or cash. John T. Wisniewski, 15801 Loomis Ave., Harvey, Ill.

WANTED — Simpson Roto-Ranger, 220 tester; RCA voltohmyst Senior. John L. Hastings, 815 N. Garland St., Memphis 7, Tenn.

WANTED — Minifone midget recorder. Advise lowest cash price. Jack Schultheis, Box 38, Linthicum, Md.

SELL OR SWAP — Phone patch in shielded metal box with gain control and adapted for push-to-talk; ARC 5 rcvr. 3-6 Mc in working cond; Weller's soldering gun 100/150 w. Want Viking Matchbox, ant, RF meter, or SWR bridge. Elliot Taynor, 64-55 Bell Blvd., Bayside 64, N. Y.

SELL OR TRADE — Zenith radio-phono, Cobra-Matic automatic record changer, 4-speed, l. n. Want good silent 16 mm movie projector with 750 w. lamp. P. J. Calderaro, 594 Main St., Wakefield, Mass.

WANTED — Used automatic 3-speed record changer in good cond. Prefer Garrard or Webcor. S. B. Miller, Box 3013, Kingsport, Tenn.

WANTED — Sams over 200 to fill library. Forrest Copithorne, 108 Lawrence Ave., Ferguson 21, Mo.

FOR SALE — B and K 500 tube checker, $75. William R. Holleran, 323 Garland St., Pittsburgh 18, Pa.

WANT — Viking Ranger or Heathkit DX-100 xmitter in A-1 cond. Must be a bargain. Ray W. Daniels, 1418 Division St., Hopkins, Minn.

SELL OR TRADE — 25 w. amplifier, $15; 2 meter rcvr., xmitter or transceiver, $12.50 each; VHF SWR, $15; 2 Selsyns meters, relays. Want test equip. R. Carthen, 408 7th Ave., Libertyville, Ill.

SWAP — Millen exciter, 80T-6V6. 6 mtr. xtal controlled transceiver, TBS; 2 Gonset 6 mtr and 2 mtr comm. Charles Radio Service, 81 Warren St., Roxbury 19, Mass.

FOR SALE — MB-40SL National tuner, A-1 cond. Used very little, $12.50 FOB. C. B. Kelley, 7204 Clovernook Ave., Cincinnati 31, Ohio.

SELL — 1956 National NC-183D with matching spkr.; 1956 B and W xmitter 5100, used slightly, all acessories, $550. George J. Bradley, 4450 Fredericksburg Rd., San Antonio, Tex.

TRADE — Heathkit LP-1 crosshatch and white dot gen. for Heathkit WA-P2, XO-1, GD-1B, BE-4, TC-2, SG-8, DR-1, AV-3, or W4-AM. Al Roark, 762 West G St., Ontario, Calif.

SELL OR TRADE — Heath AR-3 with cabinet and International crystal, FCV-I (6 meter converter), spare set of tubes, $45.50 collect or want VHF xmitters for 6 mtrs and 2 mtrs. Julian Sher, 160 Central Ave., Chelsea, Mass.

WANTED — 6 or 12 v. inverter (to 110 v.) state voltage and wattage rating, price, and make. J. Carmichael, Plant Dept., Mo. Water Co., Courtney, Mo.

FOR SALE — Hallicrafter Silvertone TV chassis 649-101-4 and 478-303, $5 each or with tubes less CRT, $10 COD; Service magazine 1955-1956 and 1957, $1.50 complete per year postpaid. John Kozma, 12450 NW 5 Ave., Miami 50, Fla.

FOR SALE — Type II-4 selsyns, 110 v. 60 cy, complete with dial pointer for beam indicator, $10 a pair; RG-8/U coax, 50 ft. length with PL-259 and P-101 connectors, $4 each. R. L. Ludlum, 824 San Miguel Rd., Concord, Calif.

SELL OR TRADE — Like new Arvin 5-transistor radio, $20 or amateur equip. Jon Meling, 248 Cass Pl., Canton, Ill.

SELL OR TRADE — Gonset 2-meter converter, $20; Eldico 2-meter xmitter no power supply, $25; ARC-5 and BC-779 schematics, 25c each. S. Consalvo, 4905 Roanne Dr., Washington 21, D. C.

FOR SALE — Jackson 655 audio osc., like new, $30. Martin Feuer, 2753 Sexton Pl., Bronx 69, N. Y.

SELL OR SWAP — Philco 48-475 AM-FM table; Eico 625 with broken meter glass; 5 hp Elgin; Shakespeare President. Want cash, 20 x 50 binoculars, Mitchell spinning outfit for left hand. Karl Nester, Van Meter, Pa.

FOR SALE — DeVry Home Radio and TV course plus kits; Heathkit shortwave rcvr AR-2, excellent cond., best offer. James H. Pruet, 2335 W. 21st Pl., Chicago 8, Ill.

SWAP — Radio parts and books for old U.S. postage stamps. Send for list. Robert Cobaugh, 29-29 213th St., Bayside 60, N. Y.

WANTED — Radio handbooks by ARRL and Pacific Pub. Co.; RCA Designers handbooks both early and late editions; Meissner "How to Build" manuals and handbooks. Marvin Gurlin, 111 White Horse Pike, Audubon 6, N. J.

SELL OR TRADE — Triplett tube tester, $15; back issues Radio & TV News 1947 thru 1957, QST & CQ 1948 thru 1957. Need issues of CQ for 1946 & 1947; Gonset Super Six converter. W. Davis, 19227 Lemay St., Reseda, Calif.

SELL OR TRADE — Lafayette LC-4 capacitor resistance tester with instructions. Write for descripion and what you have to trade. A. T. Bean, 302 S. Kent St., Winchester, Va.

FOR SALE — GE synchro rcvr. and synchro xmitter both for $10. Aram J. Barsoomian, 21 Porter St., Watertown 72, Mass.

FOR SALE — 46 47 Olds and 47 48 Mercury auto radios. Want 30-50 Mc rcvr. W. Fuller, R 1, Dimondale, Mich.

SELL OR TRADE — Knight in circuit capcitor checker; astatic AT1 TV booster, 1. n.; pair 75 TL's wtih filament xformer. Need Heath GD1 with coils and ? J. Farrier, 223 Bird, Sidney, N. Y.

SELL OR TRADE — Like new Kodak Velox 35 mm printer to 3¼" x 4½", $200, or trade for ? Al. Werhan, Manlius, N. Y.

FOR SALE — Antique tubes, mags, books, pantograph, stereoscope, slides, screen, speakers. Make offer. Harry Kuell, 18½ Thomas St., Newark, N. J.

FOR SALE — Riders Radio manuals vol. 1 and 4 to 13 incl. No reasonable offer refused. Milton Lewis, 80 Elizabeth St., River Edge, N. J.

FOR SALE — QST, 1925 and 1926; KDKA's "Radio Broadcasting News" from No. 1, Jan. 1, 1922. Best offer. Marvin Fallgatter, 406 El Cerrito Ave., Piedmont 11, Calif.

FOR SALE — Heath A-7E amplifier, perfect cond., 10 w. output, 6-tube push-pull circuit, impedance, 4-8-16 ohm, separate bass, treble and volume controls, phono-tuner switch, $25 postpaid. Ben Marconi, 120 Gatling Pl., Brooklyn 9, N. Y.

FOR SALE — Viking II and Viking VFO, 1. n., $200; SX-71 with matching speaker, 1. n., $140; complete mobile, Elmac rcvr., Viking mobile xmitter, master variable all controls, PE-103 mounts, $200. Harold Trimble, Box 406, Kilgore, Texas.

WANTED — Inexpensive communications rcvr., Hallicrafters S38, Buddy, Echophone, etc., and xmitter, Ameco, Eagle, Micomold, Mitey-Mite, etc. State price. L. Larsson, Box 18, Hagersten, Sweden.

FOR SALE — Unused TE-106 multimeter built like fountain pen, reads AC-DC 0 to 12,0-300, 0- to 600 volts 0 to 50,000 ohms, postpaid, $5.35. Ewell Churchill, Cord, Ark.

FOR SALE — Mon-Key electronic automatic key, 1. n., and 4 novice xtals never used, $30. Ronald Krzysiak, 806 Forest Ave., Antigo, Wis.

WANTED — Precision E-200 C sig. gen. State cond. and price. Ralph Hamilton, 356 South First Ave., Mt. Vernon, N. Y.

FOR SALE — Unwired audio control board, complete or in part. Write for details. Thomas Pappan, 821 Pine St., Owosso, Mich.

SELL OR TRADE — HQ129X and speaker, excellent, $160. Want large screen TV port. P. Piechowicz, Apt. C-11, Gillmore Village, Utica, N. Y.

FOR SALE — Heath sig. gen., sig. tracer, and VTVM; Zenith FM-AM clock radio; AM table mod. radio; and other electronic equip. Stanley Bombka, R 3, Eagle River, Wis.

SELL OR SWAP — Miscellaneous radio servicing equip. and parts; Sams folders 1 to 60 plus 1-drawer steel file, $50 (Phila-Trenton area); Pentron 9-T-3C tape recorder; home-brew communications type rcvr. and separate power supply. A. Brindley, 212 N. Olds Blvd., Fairless Hills, Pa.

FOR SALE — Used power trans. for DuMont 111 TV set, $6.50 postpaid. L. Cohen, 151-09-34th Ave., Flushing 54, N. Y.

SELL OR TRADE — RCA mobile unit, 152-174 Mc, type CMV-1B 12-15 w., $125; Simpson 59 4" AC ammeters, 0-5, $6; Kenyon plate transformers, 670 and 671, B and K 500 tube tester, $55. Slim's, 2025 Sunkist, Waukesha, Wis.

SELL OR SWAP — Dormitzer Synctron Strobe flash gun with charger; 120 bass Paolo Soprani full-size man's accordion with 15 treble and 6 bass shifts. Need panadapter. Russell A. Garlin, 211 Berry St., W. Pittston, Pa.

SELL OR SWAP — Weston panel meters, various ranges; small power transformers; variable and fixed capacitors; old radio equip. Want good tube tester and VOM. E. Carter, 1328 Crane St., Schenectady, N. Y.

FOR SALE — NC-300 with matching speaker; Hallicrafter S-38D and RCA ACR-155 rcvr. with Teleradio 3BZ type J-50061 xmitter. Consider reasonable offers. Walter F. Abrams, 55-37-84th St., Elmhurst 73, N. Y.

FOR SALE — Knight kits assembled; RC tester Y-124, sig. tracer Y-135, transistor tester Y-149, Superior CRT tester TV-40, all for $60. S. M. Stewart, R 2, Lucasville, Ohio.

SELL OR TRADE — BC-1100A xmitter, remote control unit; BC-625A xmitter-rcvr., needs work; BC-654 xmitter-rcvr., vibrator pack, dynamotor, cables, less xtal; BC-348P converted to 110 AC. G. R. Hohman, Woodstock College, Woodstock, Md.

SELL OR TRADE — 20A 0-140 v. powerstat, $40; 6 v. VP-540 vibrapack, $10; Sears bandsaw with motor, $50. Need Heathkit VFO, grid dip meter, 12 v. mobile converter. R. Cartier, 1035 Cilley Rd., Manchester, N. H.

FOR SALE — 6 v. Carter VSF 630 dynamotors with perfect armatures, output 600 v. @ 300 mils $35 each FOB, Express Collect. N. G. Denton, Tuckerman, Ark.

FOR SALE — Johnson Viking II xmitter with push-to-talk and VFO, change-over relays, $225 plus shipping. Harley Halverson, 169 Tasso, Palo Alto, Calif.

FOR SALE — NC-88 rcvr. with Heath Q-multiplier; Hammarlund BC-779 Super-Pro rcvr. with power supply. Complete rig. Lee Owen, R 1, Ravenna, Ohio.

FOR SALE — Sam's Photofacts Nos. 64, 93, 101-110. All 12 for $10 postpaid, or $1 per set. Walter Dietz, Acton Trailer Park., Acton, Calif.

FOR SALE — RCP 322A tube tester, $35; Heathkit scope 0-10, $75; RCA 25 w. amp., $30. Tom Blakely, 11227 E 48 St., Kansas City 33, Mo.

FOR SALE — Phono amplifier; isolated 50L6 output, with tone control and all necessary cords. Make offer. N. M. Nelson, 268 Washington Ave., Chatham, N. J.

FOR SALE — Superior TV-11 tube tester, perfect working cond., $30; large tube and tool caddy, $5. Will ship. Clinton N. Edwards, 1305 E. Chilhowie Ave., Johnson City, Tenn.

WANTED — Manual or information on E. H. Scott radio rcvr., 15-tube, made 1933 in Chicago. No model number on set; serial number A-379. M. J. Kennedy, 219 Park St., Stoughton, Mass.

WANTED — Code records or instructograph. Will trade Electro-Voice 606 mike; University speaker MM-2. E. A. DeCobert, Jr., 609 Henrietta St., Gillespie, Ill.

FOR SALE — Precise 711W power lab kit, $35; Electro-Voice X825 crossover 16 ohms, $8; power supply unit PE112A, $4; ATR vibrator power supply, 6 v. DC in. 110 v. AC out., $8; complete Air Navigation course, $25. O. H. Becker, 4750 W. 179th Pl., Tinley Park, Ill.

FOR SALE — Two power plugs for PE-103 dynamotors, $1 each post paid. Donald Slattery, Rt. 2, Box 195B, Loveland, Colo.

SELL OR TRADE — Teltape portable transistor tape recorder, battery operated, weighs 2 lbs., dubs over recorded material, for what have you plus cash or cash only. Keller, Linlithgo, N. Y.

FOR SALE — Pickering 260-DD dual-diamond cartridge, just inspected by Pickering, $45 postpaid. Kermit Laurent, 1219 Scottswood, Loves Park, Ill.

WANTED — Communication rcvr., reasonable, does not have to be working. George Fisher, 415 SW 11 St., Miami 36, Fla.

FOR SALE — Hallicrafters S40A rcvr., in excellent cond., original owner, $65. J. B. Shinal, 23 Shamrock Ave., Seneca Falls, N. Y.

FOR SALE — Riders TV vol 1, $8 and radio vols. 1 through 14, 1 to 5 abridged. You pay trans. $60 Excellent cond. H. L. Mills, 11206 Dalerose Ave., Inglewood 2, Calif.

FOR SALE — National 183 rcvr, with speaker, l. n., with instruction book, $195 FOB. William C. Martin, Broadway, Paintsville, Ky.

WANTED — Ohmite dummy antenna resistors models D-100 and D-250, 72 ohm, resistance value. L. J. Schnedorf, 610 Monroe Ave., River Forest, Ill.

WANTED — Receivers of the 1920's, other old radio gear. Must be reasonable. H. Knapp, 7307 W. 85th St., Oaklawn, Ill.

WANTED — Conn Co. Stroboconn or Strobotuner used but good. H. Hoch, 418 E 53 St., Brooklyn 3, N. Y.

SELL OR SWAP — Precise RF-AF and TV marker gen. mod. 630 and Simpson 260, for binoculars 20 x 50 or 60. Walt Erb, 3064 "A" St., Philadelphia 34, Pa.

FOR SALE — Pentron CA-14 electronic mike mixer, 4 mike and 2 phono inputs, new cond., $30; Shure 55 mike, $30 plus postage. A. A. Products, 116½ N. Court, Rockford, Ill.

SELL — Unused wired Heathkit bar gen. BGI, half price, $7.25. Straight key large silver contacts, $1 plus postage. A. C. Scofield, 119 South 23rd St., LaCrosse, Wis.

FOR SALE — Used radio and TV course in excellent cond, 100 lessons. Asking $75 or best offer. John B. Ellison, 934 Radcliffe Rd., Towson 4, Md.

WANTED — TV, portable radios, tape recorder. Have musical instruments and fishing tackle to trade. Tony Imbruno, 90 Prospect Hgts, Milford, Mass.

SELL OR TRADE — R.R. Model Craftsman magazines 1949-1957; Model Craftsman 1934-1948, (early issues collector's item); Model Railroader 1941-1957, except 1945-1946. Want TBY radio or other ham equip. You pay shipping. David McKenzie, 2119 Douglas, Rockford, Ill.

FOR SALE — Precision EV-10S VTVM with RF probe, $50; E-200, $65; E-400, $95 with xtals; 954 T chkr, $45; Philco 7030 sig. tracer, $25; HQ 129X with speaker cab, $175. J. Pellock, 715 N. 7th, Benld, Ill.

FOR SALE — Unused Hickok 691 marker adder, $75; Heathkit capacitor checker, assembled, perfect cond., and grid-dip meter, unassembled, $15 each. All with instruction books. Donald Hardy, Jr., 60½ Averyville Rd., Lake Placid, N. Y.

WANTED — VOM or VTVM. Must have 0-1000 MA range. Vlad Hamata, Schuyler, Neb.

FOR SALE — Radio-Craftsman X-ophonic artificial reverberation unit, $90; Garrard RC-98 four-speed record-changer with speed control, $55. Both FOB. Robert Slattery, 1403 Leaman, Rockford, Ill.

WANTED — Information as to source of crystal grinding powder; also want command equip., low voltage power supply or 70' of RC59 or 58U. Have pr 4-125A's to swap. C. Van Buren, 439 Bracken St. N, Twin Falls, Idaho.

SWAP OR SELL — For Hi-Fi equip. or ? Cylinder phono and records, steam engine with 3" bore or cash. F. L. Martini, 306 S. Buchanan, Edwardsville, Ill.

SELL OR SWAP — Old radios, turntables, resistors, capacitors, electrolytics, spkrs., misc. parts. Name your own price. R. H. Hansen, 7 Van Wagenen Ave., Jersey City, N. J.

WANTED — Turntable G-I 2 sp; Electronics Indus. mag. Feb. 46; old sig. gen. or coils, cond. and dial; small weld. carbon holders. Cabon, 5734 Waring, Hollywood, Calif.

FOR SALE — Supreme 600 tube and set tester, portable metal case, with all charts, $60; ATR 60 battery eliminator, 6 v., $15. Albert Hart, 207 N. Raymond St., Griffith, Ind.

FOR SALE — BC-348-L with speaker, $65; SX-28, $90. Both clean and excellent. Charles Leigh, 10 S. Lanning Ave., Hopewell, N. J.

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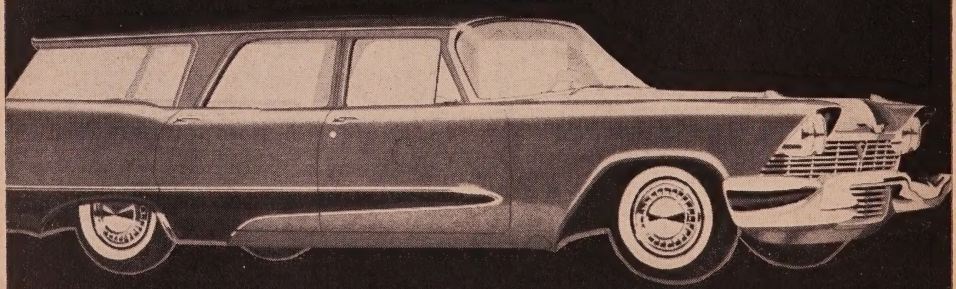

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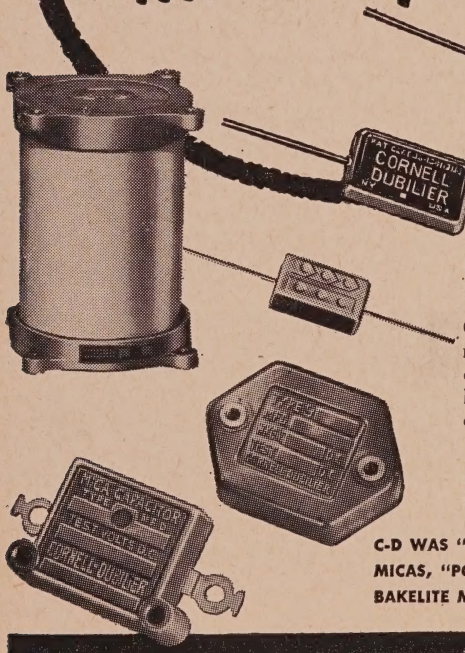

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